INTERNATIONAL STANDARD

ISO 9538

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Aerospace — Hydraulic tubing joints and fittings — Planar flexure test

Aéronautique et espace — Joints et raccords des tuyauteries hydrauliques — Essai de flexion plane

INTERNATIONAL ISO

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9538 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components.*

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Introduction

This International Standard describes a planar flexure test procedure for hydraulic tubing joints and fittings.

The test procedure may be applied as an alternative to the rotary test procedure specified in ISO 7257:1983, *Aircraft — Hydraulic tubing joints and fittings — Rotary flexure test.*

The qualification test procedures for tube fittings are specified in ISO 7169:1993, *Aerospace fluid systems — Separable tube fittings for 24° cone — General specification.*

Other test methods may be used as long as they develop the same results as the procedure specified in this International Standard.

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Aerospace — Hydraulic tubing joints and fittings — Planar flexure test

1 Scope

This International Standard specifies a flexure test procedure for reconnectable and permanent hydraulic tube joints.

This procedure is intended for conducting flexure tests on fittings with high-strength hydraulic tubes made of corrosion-resisting steel, nimonic[1)], titanium and aluminium for use on commercial and military aircraft.

2 Device for flexure test

The test device should be similar to that shown in figure 1. It shall consist of a vibrator, a manifold to receive at least six test specimens, and a hydraulic supply unit capable of constantly maintaining the static operating pressure during testing, including monitors inducing the shutdown of the system in the event of pressure drop.

Three test specimens are attached to two opposite ends of the manifold, which is rigidly mounted on the vibrator. A hose assembly establishes the connection with the hydraulic supply unit.

The vibrator shall allow for vibration frequencies up to 300 Hz.

Details of the set-up are shown in figure 2.

3 Flexure test specimens

The test specimens shall consist of the tube fitting to be tested (for example straight union), the test tube and the fitting to seal the tube.

4 Stress determination

The maximum permissible flexure fatigue stress of the test tubing is determined for the combined stress level.

The combined stress, σ_f, is composed of the tensile stress, σ_p, resulting from the internal pressure and the wall thickness of the tube, and the bending stress, σ_b.

Strain gauges shall be used to demonstrate the bending stress, and the deflection can be checked during testing by means of angle gauges.

A typical stress cycle is illustrated in figure 3.

The bending stress, σ_b, is determined by the maximum permissible flexure fatigue stress of the test tube and shall be specified for each application.

5 Procedure

5.1 Instrumentation and strain gauges

A strain gauge shall be mounted on each test specimen.

They shall be mounted as shown in figure 4.

Their location should be as follows:

a) For tube sizes to DN 16: approximately 4 mm from the attachment-point tube to fitting.

b) For tube sizes to DN 20 and above: approximately 8 mm from the attachment-point tube to fitting.

5.2 Frequency

5.2.1 Test frequency

It is recommended to perform the test at approximately 100 Hz.

1) Nimonic is an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product.

5.2.2 Natural frequency of the specimens

To minimize the power input of the vibrator used, the natural frequency of the specimens should be within the frequency range 110 Hz to 120 Hz.

The test frequency shall be approximately 10 % to 20 % below the natural frequency of the specimens to prevent their resonance range from being reached.

5.2.3 Determination of tube length

Screw the fully assembled tube, fitted with strain gauges, into the header in order to determine the tube length required. Connect the strain gauges, apply the nominal pressure and vibrate the tube. The tube length shall be adjusted until the natural frequency of the specimen is between 110 Hz and 120 Hz.

5.3 Bending stress calibration of test specimen

Submit the prepared tube to a static load (F) corresponding to the specified bending stress (see clause 4) in order to produce the required moment. After the tube bending setting is complete, introduce the specified pressure and read the stress transmitted by the strain gauge on an oscilloscope.

Start the vibrator and increase the vibration amplitude of the vibrator until the oscillograph shows the previously determined stress value.

The angle gauge allows the deflection(s) to be read for further control. The angle gauge shall be mounted at the end cap of the test specimen. To control the deflection of the test specimen, a suitable stroboscope with variable flash frequency shall be used.

6 Requirements

The flexure test specimens shall withstand 10^7 cycles.

Leakages and failures are not acceptable.

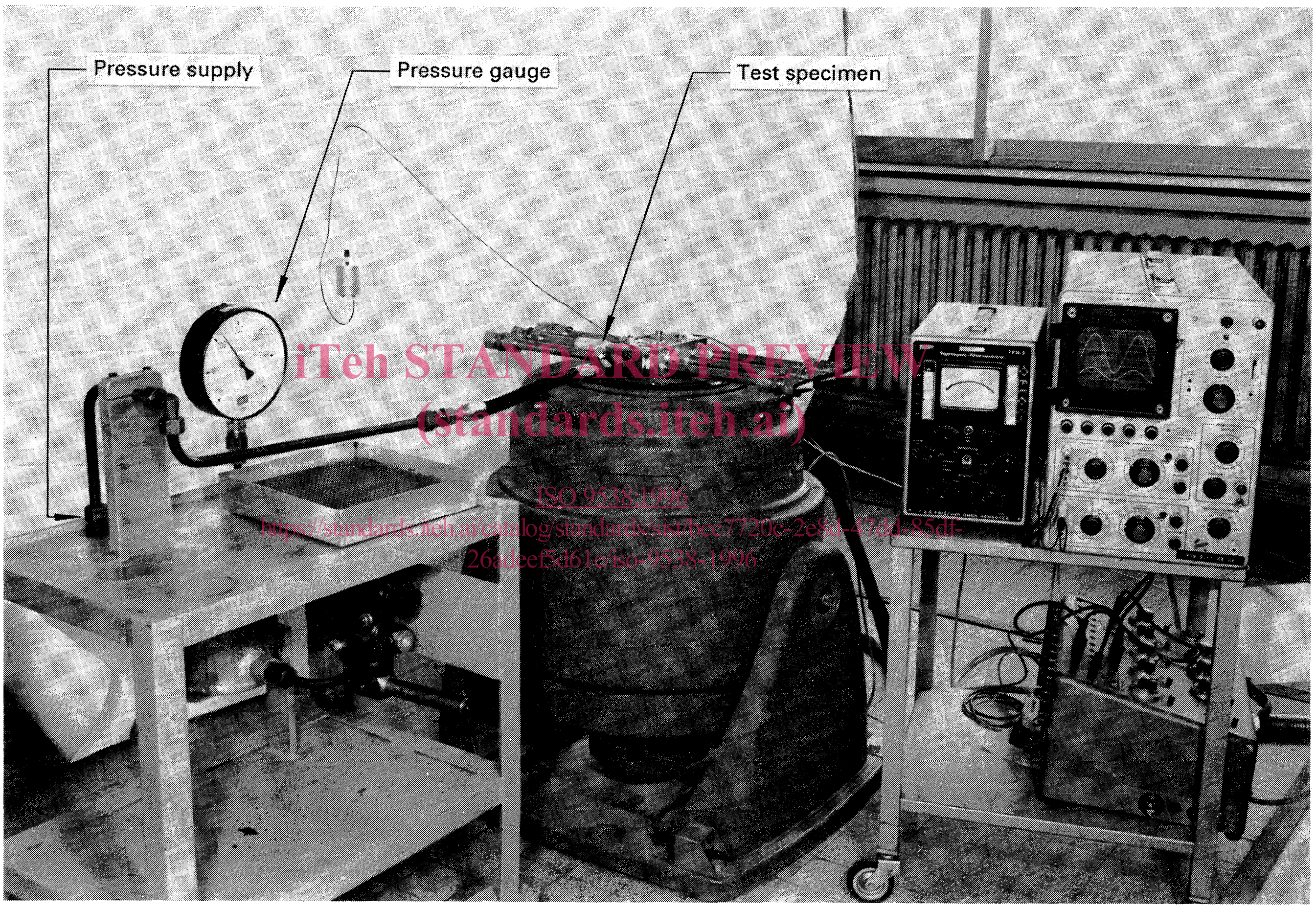


Figure 1 — Set-up of test drive

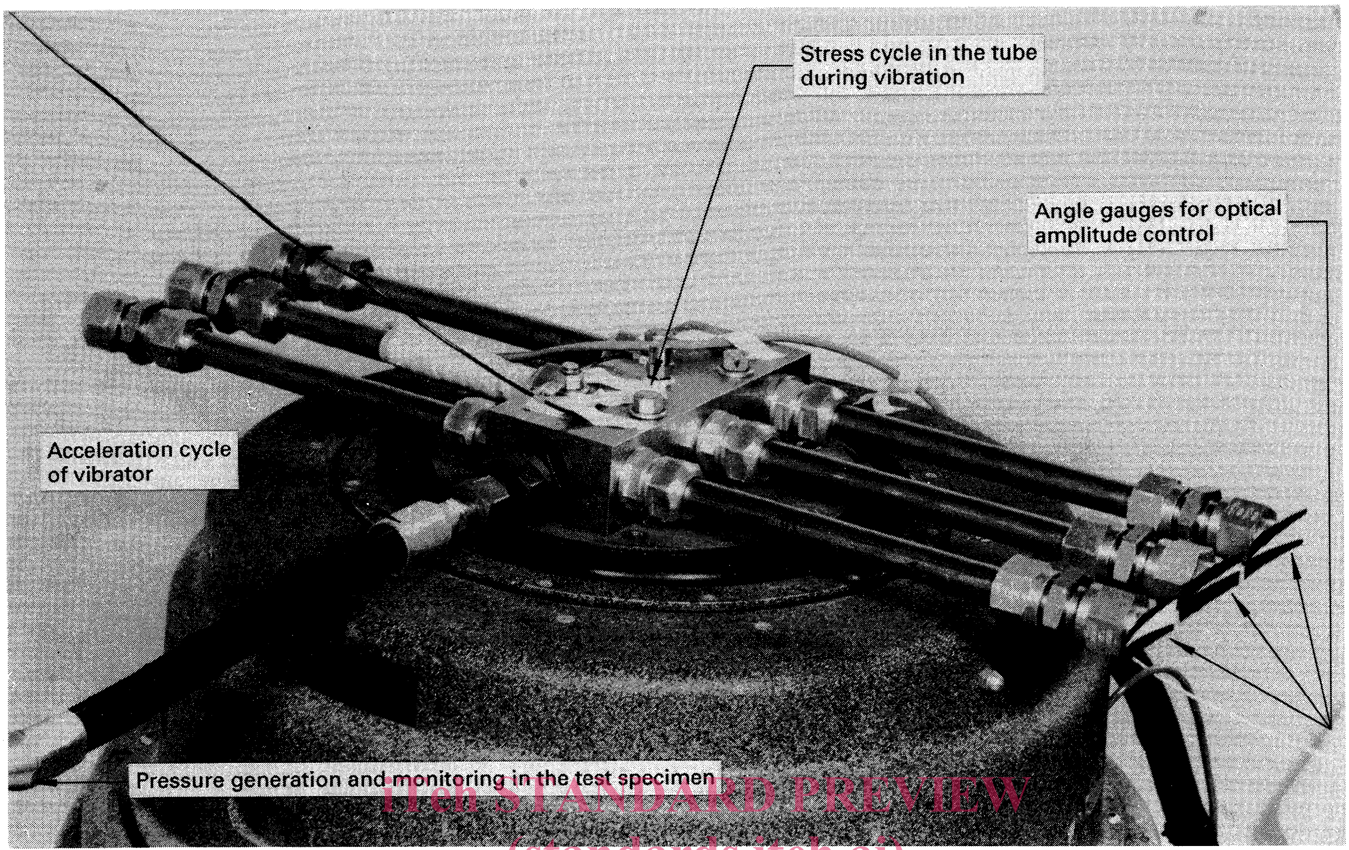
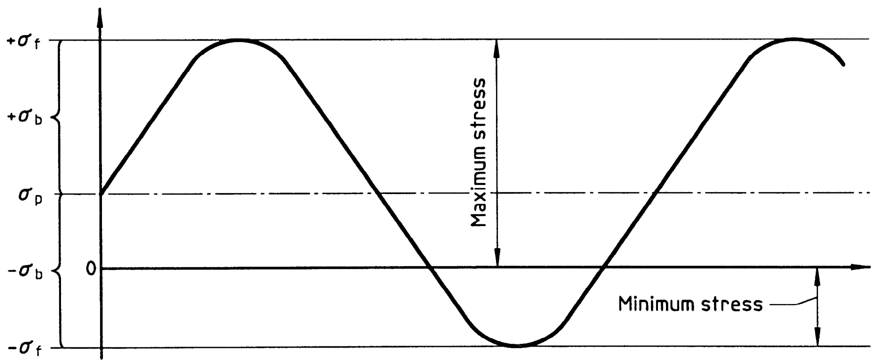


Figure 2 — Details of set-up



σ_p Mean axial stress produced by internal pressure

σ_b Stress caused by bending

σ_f Combined stress, $\sigma_p + \sigma_b$

Figure 3 — Typical test cycle

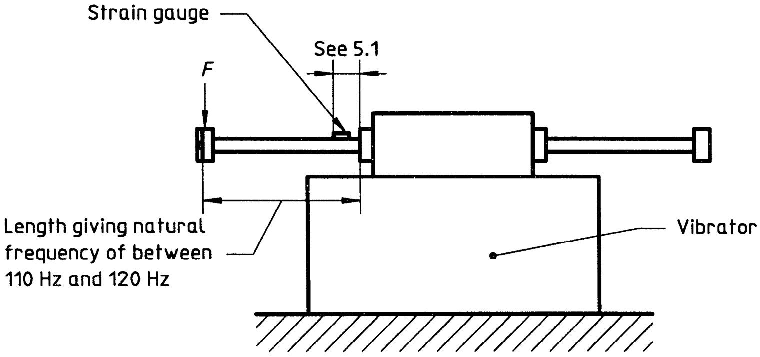


Figure 4 — Location of gauges